 **UNIVERSITY OF MAINE AT FARMINGTON**

**COLLEGE OF EDUCATION, HEALTH AND REHABILITATION**

**LESSON PLAN FORMAT**

**Teacher’s Name:** Kiera Timme **Lesson #:** 2 **Facet:** Empathy  
**Grade Level:** Grade 8 **Numbers of Days:** 2   
**Topic:** Relating Real Numbers to their Exponential Form  
  
**PART I:**  
  
**Objectives**  
Student will understand that exponents can be used to express numerical values in different, but equivalent, ways.  
Student will know primes, factors, factorization (factor trees), and positive and negative exponents  
Student will be able to relate real numbers to their exponential form  
  
**Product:**   
wix.com  
  
**Common Core State Standards (CCSS) Alignment**  
**Content Area:** Mathematics  
**Grade Level:** Grade 8  
**Domain:** *Expressions and Equations*  
**Cluster:** *Work with radicals and integer exponents*  
**Standard:** *Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 3^2 x 3^-5 = 3^-3 = 1/3^3 = 1/27*  
  
**Rationale:**   
In this class, students will use their knowledge of exponents to rewrite numerical expressions in exponential form  
  
**Assessments**   
  
**Formative (Assessment for Learning):**  
**Section I – checking for understanding during instruction**  
Students will use their math journals to reflect upon the material discussed in class. Students will also participate in the "Think, Pair, Share" activity where they will generate a step-by-step organizer to demonstrate the steps they used to solve their problem. Then, using the mix-pair freeze method, students will share their solutions with their partner.  
  
**Section II – timely feedback for products (self, peer, teacher)**  
Journals will be collected by me and written feedback will be provided. A checklist will be provided to help students create their product and ensure they have included all the necessary steps. I will review the organizers with the checklist and provide feedback. I, along with the class members, will review the wix.com products electronically and then use the same checklist to provide students with feedback, students will be given the opportunity to use the teacher and peer feedback to make any necessary adjustments.  
  
**Summative (Assessment of Learning):**  
Students will create a website using wix.com that demonstrates how real numbers can be expressed using exponents. The website should act as a study guide for anyone who wanted to learn about exponents. It should also include at least one of the following: images, videos, and audio, and all sources must be appropriately cited. The product should also include a copy of each students completed graphic organizer. This can be incorporated via a medium of the students' choosing.   
  
**Integration**  
**Technology:**   
Students will use *wix.com* to create an online exponents study guide. This product will also provide students with an opportunity to understand the basics of website design, as well as providing students with experience in incorporating audio and video into a project.  
  
**Content Areas:**   
English/Language Arts - Students will be writing in reflective journals (on-going). Since they are creating a website, student work will have a written component. They will also be required to a works cited list as part of their product.  
Art (New Media) - Students will have creative control of the overall aesthetic of their product, which must include images, videos, and audio.  
  
**Groupings**   
**Section I - Graphic Organizer & Cooperative Learning used during instruction**  
Each student will be given a number to rewrite in exponential form. Students will use the step-by-step organizer to demonstrate each step they make. Then, using the mix-freeze pair method, students will be assigned their partners. In accordance with the "Think, Pair, Share" model, students will create and then compare, with their partners and the class (via the class wiki), their step by step organizers.  
  
**Section II – Groups and Roles for Product**  
Students will work with the same partner from the in-class activity to create their website based study guide. Students will be jointly responsible for the creation of their product. To ensure an equitable division of labor, each student will be required to complete a GoogleForm survey regarding their contribution to the final product.  
  
**Differentiated Instruction**  
**Verbal:** Students will create a wix.com study guide describing how to transform real numbers into their exponential form.  
**Logic:** Students will demonstrate what thinking processes they used while rewriting the real numbers in exponential form.  
**Visual:** Student will create a step-by-step solutions organizer detailing the steps they used to solve their assigned problems.  
**Kinesthetic:** When I explain how to work with negative exponents I will have the students act out the process of bringing the number down - "Negative exponents are not happy where they are, they want to move, and then they'll be happy (positive)  
**Interpersonal:** Students will get to work together in the "Think, Pair, Share" to explain how they solved their exponent problems.  
**Intrapersonal:** During the "Think, Pair, Share" activity students will be given ample time to think independently about their assigned problem.

**Modifications/Accommodations**  
***From IEP’s ( Individual Education Plan), 504’s, ELLIDEP (English Language Learning Instructional Delivery Education Plan)*** *I will review student’s IEP, 504 or ELLIDEP and make appropriate modifications and accommodations.*  
  
**Plan for accommodating absent students:**  
The class will have its own Wiki website. All handouts and assignments, will be posted on the class wiki. At the end of the class period any SmartBoard presentations will also be uploaded onto the wiki. All students will also be provided with links to a "ShowMe" product (created by the teacher) that relates to the content being taught to supplement instruction. Anytime a new technology in introduced a student/teacher created screencast or manufacturer tutorial will be posted into the class wiki as a guide on how to use this technology.  
  
**Extensions**  
  
**Type II technology:**  
Students will use *wix.com* to create an online exponents study guide. This product will also provide students with an opportunity to understand the basics of website design, as well as providing students with experience in incorporating audio and video into a project.  
  
**Gifted Students:**  
During the class lesson and when student create their products, they will be given a menu of problem choices. From this menu, every student/group will choose two entrees and a choice of two problems from the starters and desserts. These problems will be tiered. Entrees will be designed to meet the standard, Starters will be for designed for students who are working towards the standard, and Dessert will be designed to exceed the standard as a form of extension.  
  
**Materials, Resources and Technology**

* My laptop
* Student laptop
* SmartBoard (sign-up for this)
* Step-by-step graphic organizer
* wix,com tutorial link/screencast
* "ShowMe" about converting to exponential notation
* Whiteboard
* Whiteboard markers
* Updated class wiki
* Checklist
* Handout regarding citing sources
* Link to information about citing sources
* Student product contribution self-evaluation (GoogleForm)
* Textbook
* Problems menu (Posted to class wiki)
* Calculator

**Source for Lesson Plan and Research:**  
  
**Hook:**

“Math Detective” cartoon intro:<https://www.youtube.com/watch?v=hP7K-ZiEPZw>

**Wix.com Tutorial:**  
<http://www.wix.com/createawebsite/main>  
**"ShowMe" Presentation about Converting to Exponential Form:**  
www.youtube.com (teacher account)  
**Khan Academy - Prime Factorization:**  
<http://www.youtube.com/watch?v=ZKKDTfHcsG0>  
**Prime Factorization Game:**  
<http://www.mathplayground.com/factortrees.html>  
**GoogleForm:**  
linked to class wiki (www.wikispaces.com)  
**Class wiki:**  
www.wikispaces.com  
**Citing Sources guide - Owl Purdue Writing Resources:**  
<http://owl.english.purdue.edu/owl/resource/589/01/>  
**Creative Commons website:**  
<http://search.creativecommons.org/>  
  
**PART II:**  
  
**Teaching and Learning Sequence**

**Agenda:**  
  
Day One (80 minutes):

* Attendance (3 minutes)
* Hook (2 minutes)
* SmartBoard lecture & Group Discussion about converting numbers to exponential form. Students will be given a step-by-step graphic organizer to fill out steps (20 minutes).
* Problems menu (see note), mix-pair-freeze, & Think, Pair, Share (27 minutes)
* [Prime Factorization Game](http://www.mathplayground.com/factortrees.html) (10 minutes)
* Explore wix.com and watch tutorial (10 minutes)
* Journaling (8 minutes)

***NOTE:*** *Students will choose two entree problems and at least two problems from either starter or dessert section of the problems menu*  
  
Assignment: Meet with partner to design and create studying guide using wix.com. Complete problems assigned in class if not finished.

Day Two (80 minutes):

* Attendance (5 minutes)
* wix.com product reviews. Students will use a checklist to individually evaluate their peers' products (30 minutes)
* Students will work with their partners to make any amendments to their products based on peer and teacher feedback, and/or based upon self-evaluation (30 minutes)
* Class discussion on any areas that are still unclear (10 minutes)
* Journaling (5 minutes)

Assignment: Students are make final amendments to their products and then upload a link to their site onto the class wiki. Student must also complete GoogleForm contribution evaluation linked to class wiki.   
  
*Classroom Arrangement:* Students will be arrange into table groups of two.  
  
Students will understand that exponents can be used to express numerical values in different, but equivalent, ways. Most real world experiences do not follow a straight path, they are often exponential in nature. Understanding the way exponents work represents an important building block in our understanding of the world. *Know and apply the properties of integer exponents to generate equivalent numerical expressions.* *For example, 3^2 x 3^-5 = 3^-3 = 1/3^3 = 1/27*. At the start of the lesson I will play a video of a cartoon "math detective". The purpose of the hook is to reinforce the idea that, in math, nothing we do cannot be undone. Students will be told that, during this lesson, they are math detectives, and it is their job to uncover the exponents hidden within numerical values.  
**Where, Why, What, Hook Tailors:** Verbal, Logic, Visual  
  
Student will know prime, factors, factorization (factor trees), positive and negative exponents (see content notes). We will begin by having a lecture and class discussion. For example problems go to *content notes*. During this time students will be provided with copies of the step-by-step graphic organizer to take notes. In order to reinforce the issue of negative exponents, I will select a few students who will act out the movement (up and down) of negative exponents in order to make them positive. After the discussion, student will be provided with the problems menu. Students will choose two entree problems and at least two problems from either starter or dessert section of the problems menu. Students will be instructed to work individually to formulate the solutions to their chosen problems. Each step used to solve must be written into their graphic organizer. Using the mix-freeze-pair activity, students will be assigned a partner. In their pairs, students will explain their solutions to their partner. As per the "think, pair, share" model, each pairing will challenge two other groups to fill in the missing space. Students will be given extra copies of the step-by-step graphic organizer. Students will then partially solve a problem, but will leave one step blank. The pair being challenged must discuss and agree upon the missing step. Once they have completed this task student will be given time to play the prime factorization ([factor tree](http://www.mathplayground.com/factortrees.html)) game as additional practice. Students will then reflect on the lesson, and summarize their understanding, by writing in their journals.  
**Equip, Explore, Rethink, Tailors:** Verbal, Logic, Visual, Kinesthetic, Interpersonal, Intrapersonal  
  
Students will be able to relate real numbers to their exponential form. Students will work with the same partners, assigned to them during the mix-pair-freeze activity, in order to create an online study guide about converting to exponential form. Students will be provided with class time to begin planning the creation of their products, this will include time to explore wix.com.  
Students will be jointly responsible for the creation of their product. To ensure an equitable division of labor, each student will be required to complete a GoogleForm survey regarding their contribution to the final product. Students will be instructed to create a website using wix.com that demonstrates how real numbers can be expressed using exponents. The website should act as a study guide for anyone who wanted to learn about exponents. It should also include at least one of the following: images, videos, and audio, and all sources must be appropriately cited. The product should also include a copy of each students completed graphic organizer. This can be incorporated via a medium of the students' choosing. Students will be provided with a checklist in order to self-assess and ensure their product includes the necessary steps. I will review the completed graphic organizers and provide feedback before they begin creating their product. In addition to this, I, along with their peers, will use the same checklist they have been given to provide feedback about the wix.com product. Students will then be given class time to make any adjustments based upon the teacher and peer feedback session. They will also have time to make further adjustments, outside of class, before the final submission of the product (indicated by being uploaded to the class wiki). I will then use their graphic organizers and the checklist to assess their final product.  
**Explore, Experience, Rethink, Revise, Refine, Tailors:** Interpersonal, Intrapersonal, Kinesthetic, Naturalist, Musical, Verbal, Logical, Visual.

Both the teacher and the other students will use the same checklist they have been given to provide feedback about the wix.com product. Students will then be given class time to make any adjustments based upon the teacher and peer feedback session. They will also have time to make further adjustments, outside of class, before the final submission of the product (indicated by being uploaded to the class wiki). I will then use their graphic organizers and the checklist to assess their final product.  
**Evaluate, Tailors:** Verbal, Visual, Interpersonal, Intrapersonal, Logical

**Content Notes**   
Students will know…..  
*Definitions:*

* Perfect Squares and Cubes
* Factorization (*factor trees*)
* Positive and Negative Exponents

*See attachment for complete content notes:*  
  
**Handouts**  
*Step-by-step graphic organizers*  
*Checklist*

**Maine Common Core Teaching Standards for Initial Teacher Certification and Rationale**  
  
***Standard 1 – Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.***  
  
  
***Learning Styles***  
  
***Clipboard:*** This lesson is structured to incorporate sequential learning with clear procedures on how to master the content. Lesson expectations are clearly outlined both during the lesson and on the class wiki.  
  
***Microscope:*** This lesson allows for student self-discovery of the content. Students are encouraged to discuss the content with their peers, and to develop a sense of ownership of the material. This is facilitated during the group discussion of the learning, and when students find and share their solutions with their peers.  
  
***Puppy:*** At all times every effort will be made to ensure a positive and encouraging learning environment. During the partner work, students will be encouraged (and required) to actively listen to their peer comments. During the product presentation, students will also be instructed on how to provide positively worded feedback.  
  
***Beach Ball:***The problems menu provides students with a choice in the problems they solve. Student are also free to choose, in their groupings, their roles in the product creation, and the target demographic. The problem menus also provide opportunities for extension. Students will also have the opportunity to partake in a quick skit of the method for dealing with negative exponents. The class wiki will also contain links to other resources for students to study this material.  
  
***Rationale:*** This lesson is designed to review and reinforce the material discussed in lesson one, while also introducing new material in an engaging and meaningful way for all learning styles.  
  
***Standard 6 -* *Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their on growth, to monitor learner progress, and to guide the teacher's and learner's decision making.***  
  
***Formative:*** Students will use their math journals to reflect upon the material discussed in class. Students will also participate in the "Think, Pair, Share" activity where they will generate a step-by-step organizer to demonstrate the steps they used to solve their problem. Then, using the mix-pair freeze method, students will share their solutions with their partner. Journals will be collected by me and written feedback will be provided. A checklist will be provided to help students create their product and ensure they have included all the necessary steps. I will review the organizers with the checklist and provide feedback. I, along with the class members, will review the wix.com products electronically and then use the same checklist to provide students with feedback, students will be given the opportunity to use the teacher and peer feedback to make any necessary adjustments.  
  
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***Rationale: A variety of assessment forms are used throughout this lesson. These assessments provide opportunities for both the teacher to check for understanding, and allows the students to assess their own work and levels of understanding.***  
  
  
***Standard 7* - *Planning Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.***  
  
***Content Knowledge:*** Students will be able to relate real numbers to their exponential form.  
  
  
**Common Core State Standards (CCSS) Alignment**  
**Content Area:** Mathematics  
**Grade Level:** Grade 8  
**Domain:** *Expressions and Equations*  
**Cluster:** *Work with radicals and integer exponents*  
**Standard:** *Know and apply the properties of integer exponents to generate equivalent numerical expressions. For example, 3^2 x 3^-5 = 3^-3 = 1/3^3 = 1/27*  
  
***Facet:*** Empathy  
  
***Standard 8 -* *Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.***  
  
***MI Strategies:***  
**Verbal:** Students will create a wix.com study guide describing how to transform real numbers into their exponential form.  
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***Type II Technology:*** Working in pairs, students will use *wix.com* to create an online exponents study guide. This product will also provide students with an opportunity to understand the basics of website design, as well as providing students with experience in incorporating audio and video into a project.  
  
***Rationale:*** This lesson is designed to meet the needs of six of the 8 multiple intelligences in a meaningful and engaging way. Journaling, with its reflective components, meet the needs of both verbal and intrapersonal intelligences. The physical representation of the process for dealing with negative exponents provides an opportunity for kinesthetic and visual learners to engage with the content. Group work provides interpersonal learners with the opportunity to engage with their peers. The logical structure and sequence incorporated throughout the exploration of the content appeals to logical students.  
  
  
***NETS STANDARDS FOR TEACHERS***  
**1. Facilitates and Inspire Student Learning and Creativity. Teachers use their knowledge of subject matter, teaching and learning, and technology to facilitate experiences that advance student learning, creativity, and innovation in both face-to-face and virtual environments.**  
a. Promote, support, and model creative and innovative thinking and inventiveness  
  
b. Engage students in exploring real-world issues and solving authentic problems using digital tools and resources  
  
c. Promote student reflection using collaborative tools to reveal and clarify students’ conceptual understanding and thinking, planning, and creative processes  
  
d. Model collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments  
  
***Rationale:*** In this lesson students are assigned the task of creating, with a partner, an on-line study guide using a type II technology. By doing so, students are not only using technology as a way demonstrate their learning, they are also sharing their knowledge through a virtual environment (wix.com).  
  
**2. Design and Develop Digital Age Learning Experiences and Assessments. Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning in context and to develop knowledge, skills, and attitudes identified in the NETS-S.**  
a. Design or adapt relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity  
  
b. Develop technology-enriched learning environments that enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress  
  
c. Customize and personalize learning activities to address students’ diverse learning styles, working strategies, and abilities using digital tools and resources  
  
d. Provide students with multiple and varied formative and summative assessments aligned with content and technology standards and use resulting data to inform learning and teaching  
  
***Rationale:*** Through the use of wix.com, students are provided with the opportunity to explore and utilize a type II technology as a means to demonstrate their learning in a valid and creative way.